APPENDIX A.9

TOMATILLO VARIETY EVALUATION 2002 RESULTS[1]

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INTRODUCTION

Tomatillos have been used in Central and South America for centuries for sauces, juices, and jams and as a vegetable. With the increase in the Latino population in the Northeast, this may be another alternative crop for Mid Atlantic growers. This study is part of an on going project to look at alternative crops for growers in our region.

MATERIALS AND METHODS

Culture

Seeds were sown on April 18 in 48-cell trays containing a peat-vermiculite media. The plants were maintained in the greenhouse until one week before transplanting when they were placed in an outside protected area to harden off. *Metam-sodium* (Vapam 50 gal/A) was injected three weeks before bed preparation. Field beds on 5-ft centers were prepared and black plastic mulch with drip irrigation tube was laid. Plants were set in the field using a waterwheel transplanter on May 30 in single rows with 24 inches between plants. Plants were grown on 4-ft stakes driven 10 inches into the bed. The plants were tied 4 times using the "Florida Weave" system.

Pre-plant fertilizer was applied at 60-lbs/A nitrogen as calcium nitrate, before bed making. All additional fertilizer was applied through the drip system four times during the growing season with Peters 20-20-20 at a rate of 62 lbs/A of nitrogen, P_2O_5, and K_2O for three applications and 1 application at the rate of 30 lbs/A for total nutrients of 218 lbs/A of nitrogen, P_2O_5 and K_2O per mulched acre. A total of three-pounds boron was applied with the other nutrients through the drip system.

The herbicide Napropamide (Devrinol 50DF - 3 lbs/A) was applied broadcast prior to bedding. This was followed with metolachlor (Dual Magnum II - 1.9 oz/A) and paraquat (Gramoxone Extra - 0.25 pts/A) between the beds after the plastic was laid. Insects and diseases were controlled using commercial recommendations for tomatillos. Imidacloprid (Admire - 3ml/flat) was applied as a drench to the seedling flats before transplanting in enough water to saturate the growing media without draining off. The following materials were applied to the foliage with an air blast sprayer: Avermectin-B (Agri-mek 0,15EC – 8 oz/A), azoxystrobin (Quadris - 6 oz/A) and lambdacyhalothrin (Warrior – 4 oz/A) – August 23 and cyfluthrin (Baythriod 2 – 2.8 oz/A) and chlorothalonil (Bravo Weather Stik – 3.0 pt/A) – August 27.
Rainfall was 3.86, 6.10, 2.08, 2.96, 2.53 and 5.78 inches in May, June, July, August, September and October respectively. Additional water was applied through the drip system based on tensiometer readings.

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[1]This work supported by the New Jersey Agricultural Experiment Station Program Enhancement Grant; [2]Cumberland Co. Agricultural Agent (corresponding author), 291 Morton Ave., Millville, NJ 08332; [3]Monmouth Co. Agricultural Agent, 20 Court St., Freehold, NJ 07728; [4]Gloucester Co. Agricultural Agent, 1200 N. Delsea Dr., Clayton, NJ 08312; [5]Extension Specialist in Vegetable Crops, Emeritus; [6]Research Technician in Horticulture, 121 Northville Rd., Bridgeton, NJ 08302.

EXPERIMENTAL DESIGN, HARVESTING AND EVALUATION

The cultivars were arranged in a randomized block design with three replications. Data was collected on plant characteristics (growth habit, plant vigor, and plant height). Fruits were determined to be ready to harvest when some of the fruit started to emerge from the husk or the husk started to turn from green to brown. Tomatillos were hand harvested six times on August 1, 8, 16, 24, September 11 and 30. Fruit were separated by marketable and unmarketable, counted and weighed. Culls were further divided by the type of defect (blossom end rot, insect damage, cracks, rots, undersized, sunburn and miscellaneous) and counted. All yields are reported in 30 lb boxes per acre. At the last harvest, a ten fruit sample was randomly selected from each replication to determine fruit characteristics (length, width, fruit shape, internal color, external color, and husk color) for all the cultivars. Data were statistically analyzed using ANOVA and mean separation determined with Tukey's Studentized Range Test (HSD) at the 5% level.

RESULTS AND DISCUSSION

There was no statistical difference among the cultivars as to marketable, cull or total yield or percent marketable fruit for early harvest (table1). Fruit size did vary among the cultivars with the 'Cisineros', 'Verde Puebla', and 'Toma Verde' producing statistically larger fruit than the other three cultivars. 'Pineapple' had the smallest fruit and was significantly smaller than all other cultivars. 'De Milpa' and 'Purple' were statistically larger than 'Pineapple', but smaller than the other three.

Table 1. Tomatillo yield and fruit size for early (1 and 2) harvest– Rutgers Agricultural Research and Extension Center, Bridgeton, NJ– 2002

Variety	Source	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Fruit Wt. Oz.
Cisineros	Tomato Growers	100	62	38	61	1.01
Pineapple	Tomato Growers	71	49	22	66	0.06
Purple	Tomato Growers	147	117	31	80	0.54
Toma Verde	Johnny's	112	84	28	70	0.82
De Milpa	Johnny's	72	51	21	67	0.41
Verde Puebla	Evergreen Seeds	291	233	58	74	0.83
HSD 0.05	**----------**	**NS**	**NS**	**NS**	**NS**	**0.22**

The yield data for the full season production are summarized in table 2. As with the early harvest, there were no statistical differences for marketable or total yield or percent marketable fruit. "Verde Puebla' did significantly produce more cull fruit than 'De Milpa' or Pineapple' while the other three cultivars were not different from any other cultivar. When the individual cull numbers were analyzed, 'Pineapple' had significantly more rots, cracks and miscellaneous fruit than the other cultivars (data not shown). There was a higher percentage marketable fruit over the whole season than for the early harvest. 'Cisineros' fruit was statistically larger and 'Pineapple' smaller than the other cultivars. 'Verde Puebla' was the second largest and 'De Milpa' next to the smallest. These were significantly different from each other, but did not differed neither from 'Purple' nor 'Toma Verde'.

Table 2. Tomatillo yield and fruit size for all harvests – Rutgers Agricultural Research and Extension Center, Bridgeton, NJ– 2002

Variety	Source	Total Boxes/A	Marketable Boxes/A	Cull Boxes/A	% Marketable	Fruit Wt. Oz.
Cisineros	Tomato Growers	829	705	124	85	1.21
Pineapple	Tomato Growers	446	411	35	92	0.04
Purple	Tomato Growers	649	568	81	88	0.59
Toma Verde	Johnny's	683	558	125	79	0.77
De Milpa	Johnny's	597	547	50	91	0.55
Verde Puebla	Evergreen Seeds	1009	826	183	82	0.86
HSD 0.05	**----------**	**NS**	**NS**	**112**	**NS**	**0.18**

Plant characteristics were evaluated at the end of the production season. Only 'Pineapple' was statistically different for growth habit from the other cultivars (table 3). The plant was erect and probably did not need to be staked. The other cultivars were semi prostrate and they benefited from staking. Four-foot stakes were used in this trial, but they are not long enough to support the cultivars except 'Pineapple'. Five or six foot stakes should be used. There were no statistical differences for plant vigor among the cultivars. Only 'Pineapple' was significantly shorter than the other cultivars. It averaged 4.0 ft/plant while the other ranged between 5.8 and 6.5 ft.

Table 3. Tomatillo plant characteristics – Rutgers Agricultural Research and Extension Center, Bridgeton, NJ– 2002

Variety	Source	Growth Habit[1]	Plant Vigor[2]	Plant Height (ft)[3]
Cisineros	Tomato Growers	3.6	2.7	5.7
Pineapple	Tomato Growers	1.0	3.3	4.0
Purple	Tomato Growers	3.3	2.7	5.9
Toma Verde	Johnny's	3.3	2.0	5.8
De Milpa	Johnny's	3.3	1.7	6.2
Verde Puebla	Evergreen Seeds	3.3	2.7	6.5
HSD 0.05	**----------**	**1.6**	**NS**	**1.5**

[1]1=erect, 2=semi erect, 3=semi prostrate, 4=prostrate, [2]1=excellent, 2=very good, 3=moderate, 4=fair, 5=poor, [3]Average of five plants

Fruit quality characteristics were evaluated on the last harvest (September 30). The summarized data is shown in table 4. Four of the six cultivars were ovate in shape while 'De Milpa' was round and 'Pineapple' round ovate. These last two cultivars were statistically different from each other and the other cultivars. 'Cisineros' was the longest fruit and 'Pineapple the shortest. The other cultivars were not statistically difference from one another. The fruit width data followed a similar pattern as length, but there was more mean separation among the cultivars. 'Pineapple' statistically had the narrowest fruit followed by 'De Milpa' and 'Purple'. Each of these was significantly different from one another. 'Toma Verde' and 'Verde Puebla' statistically were similar, but were narrower than Cisineros, which had the widest fruit. 'Pineapple' length to width ratio was closest to being square. None of the other cultivars was significantly different from one another.

Table 4. Tomatillo fruit shape, length, width and length to width ratio – Rutgers Agricultural Research and Extension Center, Bridgeton, NJ– 2002

Variety	Fruit Shape[1]	Length (cm)[2]	Width (cm)[2]	L/W Ratio
Cisineros	3.0	3.5	4.5	0.76
Pineapple	2.0	1.3	1.3	1.03
Purple	3.0	2.9	3.6	0.81
Toma Verde	3.0	3.2	4.0	0.80
De Milpa	1.0	2.7	3.1	0.87
Verde Puebla	3.0	3.2	4.1	0.78
HSD 0.05	**0.9**	**0.6**	**0.3**	**0.13**

[1]1=round, 2=round ovate, 3=ovate, 4=oblate -- [2]Average of ten fruit per replication

Table 5 summarizes the husk and fruit color for the different cultivars. The only variation in husk color was for the 'Purple' tomatillo, which had a green purple husk while the other cultivars were light brown. Tomatillos can be harvested anytime after the husk starts to fill thus there may be a range of colors from light green to brown. When they are harvested depends more on the market than husk color. If the cultivar is for fresh consumption i.e. 'Pineapple', it may be harvested earlier than cultivars for sauces. Immature external fruit was light to dark green in color except for 'Purple' which was purple green. Fruit varied more in mature external fruit color with 'Cisineros' and 'De Milpa' changing from dark green to light green; 'Toma Verde' and 'Verde Puebla' from green to yellow; 'Pineapple' from light green to light brown; and 'Purple' from green purple to purple. 'Pineapple' had an attractive external color at maturity and had the best flavor when tasted. All cultivars had a light green internal color as immature fruit. All were green yellow as mature fruit except 'Pineapple which was light brown and 'Purple' which was green purple. The last two were significantly different from one another and the other cultivars.

Table 5. Tomatillo husk color, external and internal fruit color for immature and mature fruit – Rutgers Agricultural Research and Extension Center, Bridgeton, NJ – 2002

Variety	Husk Color[1]	External Fruit Color[1]		Internal Fruit Color[1]	
	Mature	Immature	Mature	Immature	Mature
Cisineros	5.0	1.0	2.0	2.0	3.0
Pineapple	5.0	2.0	5.0	2.0	5.0
Purple	6.0	6.0	7.0	2.0	6.0
Toma Verde	5.0	2.0	4.0	2.0	3.0
De Milpa	5.0	1.0	2.0	2.0	3.0
Verde Puebla	5.0	1.0	4.0	2.0	3.0
HSD 0.05	**0.9**	**0.9**	**0.9**	**NS**	**1.0**

[1]1=dark green, 2=light green, 3=green yellow, 4=yellow, 5=light brown, 6=green purple, 7= purple

SUMMARY

All cultivars in the trial would be acceptable to grow. Which ones to produce depends more on the type of market than the cultivar. The only one of the six cultivars for fresh consumption is 'Pineapple' which has very good flavor and an attractive color. The main detriment for a producer is the small fruit sizes making it labor insensitive to harvest. The other cultivars are easy to harvest and grade. There are few commercial cultivars of tomatillos in the United States for evaluation. If possible, these six should be compared with the remaining cultivars before making final recommendations.